External Awards

Spectroscopy & Innovation Award
Winner: Yuko Ueno, NTT Basic Research Laboratories
Date: May 29, 2014
Organization: Spectroscopy & Innovation Consortium

For "Introduction of My Research Career at NTT R&D Center".
The lecture discussed applications of spectroscopy in the industrial field.

Best Paper Award
Winner: Akisato Kimura, NTT Communication Science Laboratories; Ryo Yonetani, The University of Tokyo; Takatsugu Hirayama, Nagoya University
Date: June 11, 2014
Organization: IEICE-ISS (Information and Systems Society of The Institute of Electronics, Information and Communication Engineers)

For "Computational Models of Human Visual Attention and Their Implementations: A Survey".
We humans are easily able to instantaneously detect the regions in a visual scene that are most likely to contain something of interest. Exploiting this pre-selection mechanism called visual attention for image and video processing systems would make them more sophisticated and therefore more useful. This paper briefly describes various computational models of human visual attention and their development, as well as related psychophysical findings. In particular, our objective is to carefully distinguish several types of studies related to human visual attention and saliency as a measure of attentiveness, and to provide a taxonomy from several viewpoints such as the main objective, the use of additional cues, and mathematical principles. This survey finally discusses possible future directions for research into human visual attention and saliency computation.

Papers Published in Technical Journals and Conference Proceedings

Giving Context to Sounds through Mediation of Physical Objects
S. Sato, M. Takahashi, and M. Matsuo
Proc. of The 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2013), Session of Poster, Demo, & Video Presentations, pp. 91–94, Zurich, Switzerland, September 2013.
We describe the concept of and approach for combining conceptual information produced by humans and data that convey situations of the real world without any modification or interpretation, which can be thought of as a method for bridging the web and the real world. We conducted an experiment to validate our concept by making associations between everyday topics or situations and their characteristic sounds. We discuss the preliminary results obtained in the experiment.

An Evaluation of Method for Encouraging Participation
H. Kawasaki, A. Yamamoto, H. Kurasawa, H. Sato, M. Nakamura, and R. Kakinuma
Proc. of UbiComp 2013, Session of 2nd ACM International Workshop on Mobile Systems for Computational Social Science, pp. 883–890, Zurich, Switzerland, September 2013.
Much attention is being focused on participatory sensing, in which real-world data are collected using personal mobile devices as sensor nodes to sense various conditions of the world we live in. In participatory sensing, there is a problem in that the supply of data is insufficient if users are not motivated to participate in sensing services. We previously proposed Top of Worlds, a method for encouraging user participation by presenting rankings in multidimensional hierarchical sets. In this paper, we describe the development of a ranking system and a real-world evaluation to confirm that Top of Worlds can encourage user participation.

Maximum Likelihood Factor Analysis with a Large Number of Missing Values
K. Hirose, S. Kim, Y. Kano, M. Imada, M. Yoshida, and M. Matsuo
Proc. of ERCIM 2013 (The 6th International Conference of the ERCIM WG on Computational and Methodological Statistics), pp. 585–612, London, England, December 2013.
We considered the problem of full information maximum likelihood (FIML) estimation in a factor analysis model when a majority of the data values are missing. The expectation-maximization (EM) algorithm is often used to find the FIML estimates, in which the missing values on observed variables are included in complete data. However, the EM algorithm has an extremely high computational cost when the number of observations is large and/or plenty of missing values are involved. We propose a new algorithm that is based on

the EM algorithm but that efficiently computes the FIML estimates. A significant improvement in the computational speed is realized by not treating the missing values on observed variables as part of the complete data. Our algorithm is applied to a real data set collected from a web questionnaire that asks about first impressions of human; almost 90% of the data values are missing. When there are many missing data values, it is not clear if the FIML procedure can achieve good estimation accuracy even if the number of observations is large. In order to investigate this, we conduct Monte Carlo simulations under a wide variety of sample sizes.

Dynamic Load-distribution Method of uTupleSpace Data-sharing Mechanism for Ubiquitous Data

Y. Arakawa, K. Kashiwagi, T. Nakamura, and M. Nakamura
IEICE Trans. on Information and Systems, Vol. E97-D, No. 4, pp. 644–653, April 2014.

We propose a new load-distribution method using a DHT (distributed hash table) called the dynamic-help method. The proposed method enables one or more peers to handle loads related to the same hash value redundantly. This makes it possible to handle the large load related to one hash value by distributing the load among peers. Moreover, the proposed method reduces the load caused by dynamic load-redistribution. Evaluation experiments showed that the proposed method achieved sufficient load-distribution even when the load was concentrated on one hash value with low overhead. We also confirmed that the proposed method enabled uTupleSpace to accommodate the increasing load with simple operational rules stably and with economic efficiency.

Evaluating Translation Quality with Word Order Correlations

T. Hirao, H. Isozaki, K. Sudoh, K. Duh, H, Tsukada, and M. Nagata
Journal of Natural Language Processing, Vol. 21, No. 3, pp. 421–444, June 2014.

Automatic evaluation of machine translation (MT) quality is essential to develop high-quality MT systems. Various evaluation metrics have been proposed, and among them, BLEU is widely used as the de facto standard metric. However, the previous methods have some problems. BLEU does not care about global word order, and this severe mistake is not penalized very much. In order to consider global word order, this paper proposes a lenient automatic evaluation metric based on rank correlation of word order. By focusing on only words common between the two translations, this method is lenient with the use of alternative words. The difference of words is measured by the precision of words, and its weight is controlled by a parameter. When the proposed method was applied using submissions of NTCIR-7 & 9's Patent Translation task, it outperformed conventional measures in terms of system level comparison.

Automatic Vocabulary Adaptation Based on Semantic and Acoustic Similarities

S. Yamahata, H. Masataki, Y. Yamaguchi, A. Ogawa, O. Yoshioka, and S. Takahashi
IEICE Trans. on Information and Systems, Vol. E97-D, No. 6, pp. 1488–1496, June 2014.

Recognition errors caused by out-of-vocabulary (OOV) words lead to critical problems when developing spoken language understanding

systems based on automatic speech recognition technology. Automatic vocabulary adaptation is an essential technique to solve these problems. In this paper, we propose a novel and effective automatic vocabulary adaptation method. Our method selects OOV words from relevant documents using combined scores of semantic and acoustic similarities. With this combined score that reflects both semantic and acoustic aspects, only necessary OOV words can be selected without registering redundant words. In addition, our method estimates probabilities of OOV words using semantic similarity and a class-based N-gram language model. Experimental results show that our method improves OOV selection accuracy and recognition accuracy of newly registered words in comparison with conventional methods.

Creating Stories from Socially Curated Microblog Messages

K. Duh, A. Kimura, T. Hirao, K. Ishiguro, T. Iwata, and A. Yeung
IEICE Trans. on Information and Systems, Vol. E97-D, No. 6, pp. 1557–1566, June 2014.

Social curation is characterized as a human-in-the-loop and sometimes crowd-sourced mechanism for exploiting social media as sensors. Although social curation web services such as Togetter, Naver Matome, and Storify are gaining popularity, little academic research has been done to study the phenomenon. In this paper, our goal is to investigate the phenomenon and potential of this new field of social curation. First, we perform an in-depth analysis of a large corpus of curated microblog data. We seek to understand why and how people participate in this laborious curation process. We then explore new ways in which information retrieval and machine learning technologies can be used to assist curators. In particular, we propose a novel method based on a learning-to-rank framework that increases the curator's productivity and breadth of perspective by suggesting which novel microblogs should be added to the curated content.

Probing the Time Course of Head-motion Cues Integration during Auditory Scene Analysis

H. Kondo, I. Toshima, D. Pressnitzer, and M. Kashino
Frontiers in Neuroscience, Vol. 8, No. 6, Article 170, June 2014.

We showed that motor cues had a different time course compared to acoustic or subjective location cues; motor cues impacted perceptual organization earlier and for a short time than other cues, with successive positive and negative contributions to auditory streaming. An additional experiment controlled for volitional control components, and found that arm or leg movements did not have any impact on scene analysis.

Mechanical Resonance Characteristics of a Cylindrical Semiconductor Heterostructure Containing a High Mobility Two-dimensional Electron Gas

H. Okamoto, W. Izumida, Y. Hirayama, H. Yamaguchi, A. Riedel, and K.-J. Friedland
Physical Review B, Vol. 89, 245304, June 2014.

We investigate the mechanical resonance characteristics of semiconductor rolled-up tubes containing a high-mobility two-dimensional electron gas (HM2DEG) by optical and electrical means. The observed mode frequencies are in an excellent agreement with the theoretically calculated frequencies for the ground bending and excited bending and axial modes. The effect of the curvature is to increase the frequencies of the ground bending modes and the axial

wave modes, while decreasing the frequencies of the first excited bending modes. We find significant splitting of the bending and twisting modes by the residual stress effects due to axial shear relaxation in z-dependent modes. The HM2DEG interacts with the mechanical motion due to Eddy currents and embedded impedances. A prominent asymmetry appears in the vibration amplitude with respect to the direction of the magnetic field. This originates from the broken symmetry of the HM2DEG on the curved surfaces.

Single-electron Thermal Noise

K. Nishiguchi, Y. Ono, and A. Fujiwara
Nanotechnology, Vol. 25, No. 27, June 2014.

We report the observation of thermal noise in the motion of single electrons in an ultimately small dynamic random access memory (DRAM). The nanometer-scale transistors that compose the DRAM resolve the thermal noise in single-electron motion. A complete set of fundamental tests conducted on this single-electron thermal noise shows that the noise perfectly follows all the aspects predicted by statistical mechanics, which include the occupation probability, the law of equipartition, a detailed balance, and the law of kT/C. In addition, the counting statistics on the directional motion, i.e., the current, of the single-electron thermal noise indicate that this noise can be described as hot noise as well.